

ACCESSION #: 9607030027

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Perry Nuclear Power, Unit 1 PAGE: 1 OF 5

DOCKET NUMBER: 05000440

TITLE: Automatic Reactor Scram Following Auxiliary Transformer

Failure

EVENT DATE: 05/30/96 LER #: 96-005-00 REPORT DATE: 06/27/96

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: Keith R. Jury, Supervisor - TELEPHONE: (216) 280-5594

Compliance Unit

COMPONENT FAILURE DESCRIPTION:

CAUSE: B SYSTEM: EA COMPONENT: XFMR MANUFACTURER: X999

B EA XFMR G182

REPORTABLE NPRDS: YES

YES

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On May 30, 1996, at 0616 hours, the Perry Nuclear Power Plant (PNPP), Unit No. 1, was operating at 100 percent rated thermal power, when an automatic reactor scram occurred due to an auxiliary transformer sudden pressure signal and subsequent main generator

lockout, main generator trip, and turbine control valve fast closure. The event was initiated when 13.8 kV circuit breaker L1108 was re-closed following replacement and post maintenance testing. The circuit breaker tripped open in response to a failure of the associated nonsafety load center transformer, LF-1-C. As a result of this transient, the 22 kV/13.8 kV auxiliary transformer, 110-PY-B, developed a sudden pressure signal due to internal winding damage which was caused by the through-fault current generated when the LF-1-C transformer failed. This damage rendered the auxiliary transformer inoperable, resulting in the reactor scram. The nonsafety electrical loads automatically transferred to the inservice start-up transformer, 200-PY-B, during the event; safety-related loads were being supplied by the start-up transformer at the time of the event. Plant systems and components functioned as designed with the exception of the auxiliary transformer, which should have been able to accept the through-fault current received. This event had minimal safety significance since safety-related electrical loads were not affected, and the plant was stabilized within the bounds of normal operating procedures.

The corrective actions for this event include: replacement of the failed transformers; evaluation on the necessity of load center transformer upgrades; and, evaluation and/or validation of the susceptibility of other critical transformers to the mechanisms which caused the respective failures. This event is reported in accordance with 10 CFR 50.73(a)(2)(iv) as an automatic actuation of the Reactor Protection System.

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I. Introduction

On May 30, 1996, at 0616 hours, Perry Nuclear Power Plant (PNPP), Unit

No. 1 experienced a reactor scram as a result of the failure of nonsafety

13.8 kV/480 V load center transformer [XFMR] LF-1-C and the resultant

failure of the 22 kV/13.8 kV auxiliary transformer [XFMR], 110-PY-B.

Plant systems responded to the failed auxiliary transformer in the

following sequence: an auxiliary transformer sudden pressure signal; main

generator lockout; main generator trip; and, turbine control valve fast

closure which automatically initiated the reactor scram. This event is

reported in accordance with 10 CFR 50.73(a)(2)(iv), as an automatic

actuation of the Reactor Protection System (RPS) [JC]. The event was

also reported via the Emergency Notification System in accordance with 10 CFR 50.72(b)(2)(ii).

At the time of the event, the plant was in Operational Condition 1 at 100 percent of rated thermal power. The reactor pressure vessel pressure was at approximately 1,024 psig with the reactor coolant at saturated conditions.

II. Event Description

On May 30, 1996, 13.8 kV circuit breaker [52] L1108 was being replaced with a refurbished unit as an ongoing preventative maintenance plan to resolve breaker grease hardening effects. To facilitate this maintenance activity, nonsafety load center transformer LF-1-C was de-energized on the low voltage (i.e., 480 V) side. The auxiliary transformer, 110-PY-B, was in a normal electrical configuration providing power to the plant's nonsafety loads, including 13.8 kV bus [BU] L11. Circuit breaker L1108 connects load center transformer LF-1-C to bus L11.

Following the replacement of circuit breaker L1108 and satisfactory completion of post maintenance testing, the circuit breaker was reopened; the maintenance and testing was determined to be complete. Within approximately five minutes following the breaker test, circuit breaker L1108 was closed to return it to service. When the operator closed the circuit breaker, transformer LF-1-C failed while unloaded, causing circuit breaker L1108 to reopen as designed, which cleared the fault. The transient caused auxiliary transformer 110-PY-B to unexpectedly fail

as a result of the through-fault current, which rendered it incapable of supplying its associated loads.

The auxiliary transformer's failure actuated its internal sudden pressure relay for approximately 20 milliseconds, after which the signal cleared.

The sudden pressure signal initiated a main generator lockout signal causing a main generator trip followed by a turbine control valve fast closure which automatically actuated the RPS (i.e., initiated a reactor scram).

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II. Event Description (continued)

Plant systems and components functioned as designed during the transient except for the auxiliary transformer, which should have handled the through-fault current. The plant's nonsafety electrical loads automatically transferred to the 345 kV/13.8 kV startup transformer, 200-PY-B, following the reactor scram; safety-related loads were being supplied by this transformer when the transient occurred. This event had minimal safety significance since the safety-related loads were not affected and the plant was stabilized with use of normal operating procedures. Extensive investigation/evaluation efforts were initiated, and load center transformer LF-1-C and auxiliary transformer 110-PY-B were replaced with on-site spare transformers.

In addition, on June 2, 1996, with the plant in Operational Condition 4 during the resultant forced outage, 13.8 kV/480 V load center transformer

LF-1-E was observed by the operating shift crew to be making an unusual cyclical noise. In response to this unusual noise, the operating shift crew, with concurrence from Engineering staff personnel, isolated the transformer from the load bus. When the operator opened the supply side circuit breaker, the transformer failed. The auxiliary transformer event investigation was expanded to include this failure. Load center transformer LF-1-E was also replaced with an additional on-site spare transformer.

III. Cause

The auxiliary transformer failure investigation determined that the through-fault current, as seen by this transformer, was within the design limits of the transformer. Physical damage to the auxiliary transformer included: external deformation of the transformer tank casing; cracks in external reinforcement member welds; and, substantial internal damage. Since the transformer installation was not designed to electrically isolate from the main generator, additional damage was incurred by the transformer during generator coastdown. Accordingly, the auxiliary transformer was found to have an "A" phase high to low fault, and a "B" phase uninsulated splice which apparently resulted from the design and/or assembly practices that existed when the transformers were manufactured. In addition, inspection of the two failed load center transformers, LF-1-C and LF-1-E (i.e., 1500 kVA/2000 kVA, ITE Gould, three phase, dry type, forced air cooled), indicated that the failure mechanism of both

transformers was attributed to corona-related insulation failure resulting in turn-to-turn winding failures. The cause of the corona can be primarily attributed to the marginal design and testing practices that existed at the time of manufacturing, approximately 16 years ago. Current design practices incorporate corona reduction techniques and subsequent verification testing following manufacture. The 4.16 kVA/480 V safety-related transformers are not expected to be susceptible to this phenomenon based on these transformers operating at lower voltages and due to manufacturer design differences.

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IV. Safety Analysis

The event described in this report resulted in an actuation of the RPS. Plant safety systems functioned as designed within the bounds of normal operating procedures. The only unexpected operational occurrence was the failure of the auxiliary transformer, since the transformer should have been capable of handling the through-fault current. At no time was there an interruption of power to safety-related plant equipment. The sudden loss of electrical load, as seen by the reactor, was well within the bounding analyses of the Updated Safety Analysis Report. Therefore, this event had minimal safety significance.

V. Similar Events

None

VI. Corrective Actions

The corrective actions for this event include: replacement of the failed auxiliary and load center transformers; engineering evaluation on the necessity of load center transformer upgrades; and, an engineering evaluation to determine whether the replacement auxiliary transformer is adversely affected by the manufacturing design and/or assembly practices which resulted in the failure of auxiliary transformer 110-PY-B. In addition as an interim preventative measure, the fans for the load center transformers were placed in continuous operation to maintain transformer core temperatures lower than normal in order to conservatively minimize any aging effects due to heating.

Energy Industry Identification System (EIIS) codes are identified in the text as [XX].

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The following table identifies those actions committed to by the Perry Nuclear Power Plant (PNPP),

Unit No. 1 in this document. Any other actions discussed in the submittal represent intended or planned actions by the PNPP, Unit No. 1.

They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the Manager-Regulatory Affairs at the PNPP, Unit No. 1, of any questions regarding this document or any associated regulatory commitments.

Commitment Committed Date

The necessity for load center transformer September 10, 1996

upgrades will be evaluated.

A validation will be performed to determine September 10, 1996
that safety-related transformers are not
susceptible to a similar failure mechanism.

An evaluation will be performed to determine September 10, 1996
whether the replacement auxiliary transformer
is adversely affected by the failure
mechanism(s) of the failed auxiliary transformer.

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ENERGY

PERRY NUCLEAR POWER PLANT Mail Address: Donald C. Shelton

10 CENTER ROAD P.O. BOX 97 SENIOR VICE PRESIDENT

PERRY, OHIO 44081 PERRY, OHIO 44081 NUCLEAR

(216) 259-3737

June 27, 1996

PY-CEI/NRR-2066L

United States Nuclear Regulatory Commission

Document Control Desk

Washington, DC 20555

Perry Nuclear Power Plant

Docket No. 50-440

LER 96-005

Gentlemen:

Enclosed is Licensee Event Report 96-005, Automatic Reactor Scram

Following Auxiliary Transformer Failure.

If you have questions or require additional information, please contact

Mr. James D. Kloosterman, Manager - Regulatory Affairs at (216) 280-5833.

Very truly yours,

for Donald C. Shelton

DTG:dtg

Enclosure: LER 96-005

cc: NRC Region III Administrator

NRC Resident Inspector

NRC Project Manager

Operating Companies

Cleveland Electric Illuminating

Toledo Edison

*** END OF DOCUMENT ***
